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ABSTRACT

William James, the turn of the century psychologist, philospher, and educator, was avidly interested in the relationship between psychology and teaching. This paper considers operant conditioning, timing of reinforcers, and programmed instruction--touchstones of B.F. Skinner in the teaching/learning milieu. Of course, materials not just methods are critical, and materials ought to emphasize psychologically and educationally sound life experiences. Oterwise, operant conditioning will not be as successful as it ought to be. Included are historical and historical references and cumulative references. (Author)

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A Psychology of Teaching

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Abstract

William James, the turn of the century psychologist, philosopher, and educator, was avidly interested in the relationships between psychology and teaching. This paper considers operant conditioning, timing of reinforcers, and programmed instruction - touchstones of B. F. Skinner in the teaching/learning milieu. Of course, materials not just methods are critical, and materials ought to emphasize psychologically and educationally sound life experiences. Otherwise, operant conditioning will not be as successful as it ought to be. Included are historical references and cumulative references.

In 1899, William James wrote about the relationships between psychology and teaching. In essence, he considered psychology a science and education an art; he said that science did not generate art directly (Pedrini & Pedrini, 1979). What was and is needed, is an inventive person who understands and appreciates both the background principles and the foreground applications (Skinner, 1954). This ought to apply in teacher education and in student education.

This paper does not consider many different kinds of psychologies; but it does consider one kind of psychology--instrumental conditioning (operant conditioning, Skinnerian conditioning) as contrasted to classical conditioning (respondent conditioning, Pavlovian conditioning). The Psychological conditioning or behavioral evolution in the United States began with E. L. Thorndike and J. B. Watson, continued with E. R. Guthrie, and has been epitomized by B. F. Skinner.

In addition to the above terms, some related cogent terms are behavior modification, behavior shaping, behavior therapy, programmed instruction, teaching machines, and computer-assisted instruction (Freedman & Morrison, 1983; Holland & Skinner, 1961; Skinner, 1958, 1968). Some teaching methodologies are based upon operant conditioning (as a generic notion), for example, the engineered classroom, token reinforcement programs, precision teaching, and performance contracting (AECT, 1979). For an

elaborate bibliography with many categorizations, including the above, see Pedrini and Pedrini (1988).

Of course, psychologically and educationally sound materials ought to be considered, not just methods (Pedrini & Pedrini, 1973). Otherwise, operant conditioning will not be as successful as it ought to be. In operant conditioning, behavior is controlled by consequences and may be shaped, accelerated, or decelerated. In schools, positive reinforcement (often called reward) should be emphasized selectively (i.e., given when the correct or desired response is emitted or elicited). From a Skinnerian frame of reference, differentiations (in operant conditioning) ought to be made between positive reinforcement, negative reinforcement, and punishment (Skinner, 1963).

Positive reinforcement generally occurs during or after a response, is rewarding as a stimulus, strengthens the response, and may lead to desired behavior. Negative reinforcement generally occurs before or during a response, is aversive as a stimulus, strengthens the response, and may lead to rigid behavior. Punishment generally occurs during or after a response, is aversive as a stimulus, weakens the response, and may lead to deceptive behavior. Negative reinforcement is the difficult model to understand. The stimulus is aversive, but the situation is not since it tends to enhance the behavior sought. It is best understood in terms of avoidance or escape behavior. The negative

or aversive stimulus is withdrawn or removed as soon as the behavior sought is manifested. Unfortunately, societies and cultures in general (including our own) seem to focus on negative reinforcement and punishment. Skinner (1971, 1976, 1978) believes in emphasizing positive reinforcement.

The scheduling of positive reinforcers (or negative reinforcers or punishers if one is so inclined) is critical. This discussion will focus on positive reinforcement. Continuous positive reinforcement (given for all correct responses) is important in establishing behavior. Intermittent positive reinforcement (given for some correct responses) is important in maintaining behavior. Furthermore, intermittent reinforcement may follow a ratio schedule or an interval schedule.

In a ratio schedule, the pupil is reinforced dependent upon the number of responses. Reinforcement may be given after a fixed number of correct responses or may be given after a variable number of correct responses. In a fixed ratio, a schedule of five to one would mean that every fifth correct response is rewarded. In a variable ratio a schedule of five to one would be an average, only. Following a table of random numbers (or some other format of nonsystematized bias) the first reinforcer might occur after the third correct response, the second reinforcer might occur after the seventh correct response (for ten trials, you would have a variable ratio average to five to one).

In an interval schedule, the pupil is reinforced dependent upon the passage of time. Reinforcement may be given when a correct response occurs after a fixed period of time. In a fixed interval, a schedule of two minutes would mean that after two minutes, the next correct response is rewarded (and this continues every two minutes: two minutes, four minutes, etc.). In a variable interval, a schedule of two minutes would be an average, only. Following a table of random numbers (etc.), the first reinforcer might occur for the correct response after three minutes, the second reinforcer might occur for the correct response after one minute (for four minutes, you would have a variable interval average of two minutes).

In positive reinforcement, you reward only the desired response. The scheduling above may be equated as the number of reinforcements. Thus, you may compare the efficacy of schedules: continuous or intermittent, ratio or interval, fixed on variable (e.g., see Ferster & Skinner, 1967).

Well written (framed) programmed instruction materials focus on positive reinforcement and may encompass various modes, for example, books, tapes, and film strips (Hendershot, 1986). Programmed learning (or more accurately, conditioning) takes place in small steps, with immediate knowledge of results, with active participation, with few or no errors, and at one's own pace (e.g., see Holland & Skinner, 1961).

Conditioning in small steps allows the student to progress successively from the simple to the complex. Each successive step is mastered in turn, which prevents the material from becoming confusing or aversive, and requires the student to use the material previously presented.

Conditioning with immediate knowledge of results provides the student with information as to his progress. Positive reinforcement is most effective when given for correct responses after each step in the process. The sequencing becomes rewarding.

Conditioning with active participation is more effective than with passive participation. If the student is personally responding to the step-by-step process and is receiving positive reinforcement for correct responses, he will tend to learn faster and remember longer.

Conditioning with few or no errors is most successful since making mistakes may be time consuming and frustrating. When many mistakes are made, it can mean that there is poor logical ordering between steps and/or that the steps in the program are too large.

Conditioning at one's own pace requires the student to complete and understand a step before proceeding. Conditioning is usually best when the student proceeds at his own rate. Of course, his rate is determined, in large part, by his social and environmental operants (positive and negative). Skinner does not care for the word "motivation," which is often used as a

mentalism. A student succeeds because he was motivated? A student fails because he was not motivated? All we need to do, according to Skinner, is describe what happened and how it happened in a behavioral context. The word "motivation" (a favorite of pedagogues) no longer is necessary and it certainly does not suffice.

The principles discussed above are applicable to books or to devices (teaching machines and computers). With linear programming (students follow the same path), there seems to be no conditioning advantage favoring devices over books. With branching programming (students follow alternative paths depending upon their response to a particular item), there may be a conditioning advantage favoring devices over books. Computer-assisted instruction is based on the interaction of a learner and a computer, using programmed sequences, to augment individual instruction. Computer-managed instruction is based on the interaction of a teacher and a computer, using automatic data processing, to augment record keeping, prescribing, testing, grading, etc. There are breakthroughs which allow coupling of computer programmed materials (input and output) with individual student EEG (electroencephalogram) brain-wave patterns (e.g., see Lubar & Lubar, 1984). Currently, the hardware is expensive, but eventually with more delimited hardware and with more production, the per unit cost will not be as prohibitive.

For information on operant psychology, consider Psychological Abstracts. For reference to psychological processes and instruments, specifically related to teaching/learning, consult the redoubtable ERIC (especially the Clearinghouse on Information Resources). Skinner (1984) writes of "The shame of American education" (see also Zientara, 1984). As an antidote, let us attempt rigorous applications of operant methods, materials, and milieus. Let the teachers and the curricula mirror a reliance upon some of the best proved principles in psychology.

Let us reduce the inordinate drop-out, and flunk-out rates. Year after year, the subaverage (slow-learner and special-education students) fall further and further behind their peers (Pedrini & Pedrini, 1980). The supra-average retrogress or retrograde towards the mean, the subaverage retrogress or retrograde towards the lower end of the student distribution. We need progression, not regression. We need to follow well established principles of psychology, especially behavioral psychology in teacher education and in student education.

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